

Mumbai University

Question Paper

**[IDOL – REVISED COURSE]
(MAY – 2018)**

PAPER - II

**DIGITAL SIGNALS
AND SYSTEMS**

Time: 3 Hours

Total Marks: 100

N.B.: (1) All Question are Compulsory.

(2) Make Suitable Assumptions Wherever Necessary And State The Assumptions Made.

(3) Answer To The Same Question Must Be Written Together.

(4) Number To The Right Indicates Marks.

(5) Draw Neat Labeled Diagrams Wherever Necessary.

(6) Use of Non – Programmable Calculator is allowed.

Q.1 ATTEMPT ANY TWO QUESTIONS: (10 MARKS)

- (A) Show whether the following systems are linear and time varying: (5)
- (i) $y(n) = nx(n)$
- (ii) $y(n) = nx^2(n)$
- (B) Define the following: (5)
- (i) Energy signals and Power Signals
- (ii) Aperiodic and Periodic Signals.
- (C) Write the advantages of digital signal processing over analog signal processing? (5)
- (D) Deduce Fourier series for waveform of positive going rectangular pulse train. (5)

Q.2 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)

- (A) What is sampling theorem? State the sampling theorem? (5)
- (B) Determine the Z-transform of the given sequence $x(n) = n \sin(n)$. (5)
- (C) Determine the pole-zero plot for the system described by difference equation $y(n) - 3/4y(n-1) + 1/8y(n-2) = x(n) - x(n-1)$. (5)
- (D) Write a short note on Poles and zeros of a system function? (5)
- (E) Explain how analog signals get converted into digital signals. (5)
- (F) Define digital signal processing and write the advantages of digital signal processing? (5)

Q.3 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)

- (A) State and prove Parseval's Theorem or Rayleigh's Energy Theorem. (5)
- (B) Obtain the Laplace transform of the unit step and impulse response of R-C circuit (5)
- (C) Discuss final value theorem in Laplace transforms domain. (5)
- (D) Derive from the principals, the Laplace transforms of a unit step function. (5)
- (E) Find the Laplace Transform of the $t \sin at$. (5)
- (F) Define Region of Convergence of Laplace transforms? Write its significance? (5)

Q.4 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)

- (A) Define z transform and inverse Z-transform briefly? (5)
- (B) Determine the convolution of the two sequences $x(n) = \{2,1,0,0,5\}$ and $h(n) = \{2,2,1,1\}$. (5)
- (C) Derive the relationship between the Fourier transform and Z-transform. (5)
- (D) State and discuss the five properties of region of convergence. (5)
- (E) State the Partial fraction Expansion Method to calculate inverse Z-transform. Find the inverse Z transform of $X(z) = z/(z-3)(z-4)$. (5)
- (F) Evaluate frequency response of system described the system function $H(z) = 1/1 - 0.5z - 1$. (5)

TURN OVER

Q.5 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)

- (A) Show that the system function described by the differential equation $dy(t)/dt + 10y(t) + 5 = x(t)$ is nonlinear. (5)
- (B) Determine DFT of sequence whose values for one period is given by $x(n) = \{1, 1, -2, -2\}$. (5)
- (C) What are the properties of Frequency response in case of z-transform? (5)
- (D) Define the property of superposition in case of linear systems. (5)
- (E) Obtain circular convolution of following sequences $x(n) = \{1, 2, 1\}$ and $h(n) = \{1, -2, 2\}$. (5)
- (F) How will you obtain linear convolution from circular convolution? (5)

Q.6 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)

- (A) State and explain any four properties of DFT. (5)
- (B) Determine DFT of sequence whose values for one period is given by $x(n) = \{1, 1, -2, -2\}$. (5)
- (C) Distinguish between linear convolution and circular convolution of two sequences? (5)
- (D) State the relationship between DFT and z-Transform. (5)
- (E) Obtain circular convolution of following sequences $x(n) = \{1, 2, 1\}$ and $h(n) = \{1, -2, 2\}$. (5)
- (F) Define Discrete Fourier Transform (DFT) for a sequence $x(n)$. (5)

Q.7 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)

- (A) Write a short note on Elliptic filters. (5)
- (B) Obtain the system function for normalized Butterworth filter for order $N = 1$ and $N = 2$. (5)
- (C) Determine the unit sample response of the ideal low pass filter. Why is it not realizable? (5)
- (D) State the advantages of Digital filters. (5)
- (E) Write a short note on Chebyshev Filters. (5)
- (F) Discuss and derive the frequency response of the linear phase FIR filters. (5)
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